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The Impact of Broadband on Jobs and the German Economy

This study calculates the impact of investment in broadband technology on German employment and economic output. Two sequential investment scenarios are analysed: the first one reflects the government's National Broadband Strategy that extends through 2014, and the second covers the ultra-broadband evolution from 2015 to 2020. The authors conclude that the required investment of close to 36 billion euros is justified by the substantial benefits that would be generated in terms of both additional jobs and GDP growth.

In times of economic crisis, national governments look for policy actions that can rapidly deal with rising unemployment and declining output. Infrastructure investments have been identified as key tools in the fight against the current crisis because of the direct and indirect short-term labour effects in the construction industries and the substantial spillovers, in terms of improving efficiencies and stimulating innovation, into the production sector of the economy. As a result, several governments (including those of Germany, the United States, Australia, Portugal, Singapore, New Zealand and Ireland) have recently decided to actively promote telecommunications investment.

The economic benefits of broadband infrastructure are significant.[1] In information-intensive economies – such as Germany, where 54 per cent of the economically active workforce is considered to be information-based (from IT professionals to content producers and clerks) – the deployment of infrastructure to facilitate the flow of information has an impact on productivity, innovation and business growth.[2] In fact, multiple studies also point out that rankings in national competitiveness and network readiness are directly correlated.

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The objective of this study is to estimate the impact of broadband infrastructure investments on the German economy, in particular on employment and output. This study analyses the potential effects of Germany's "National Broadband Strategy", which is expected to be completed by 2014.[3] In addition, the study assesses the economic impact of a second phase of ultra-broadband evolution, which will result in a more advanced broadband network and which it is assumed will be completed by 2020.

The study relies on a three-step approach. First, the total costs for broadband deployment in Germany by 2014 and 2020 are determined. Second, by relying on input-output tables generated by the German Statistical Office and utilising input-output analysis, the workforce which will be created by the roll-out of modern broadband is estimated. Third, regression-based forecasting is used to calculate the externalities of broadband deployment.

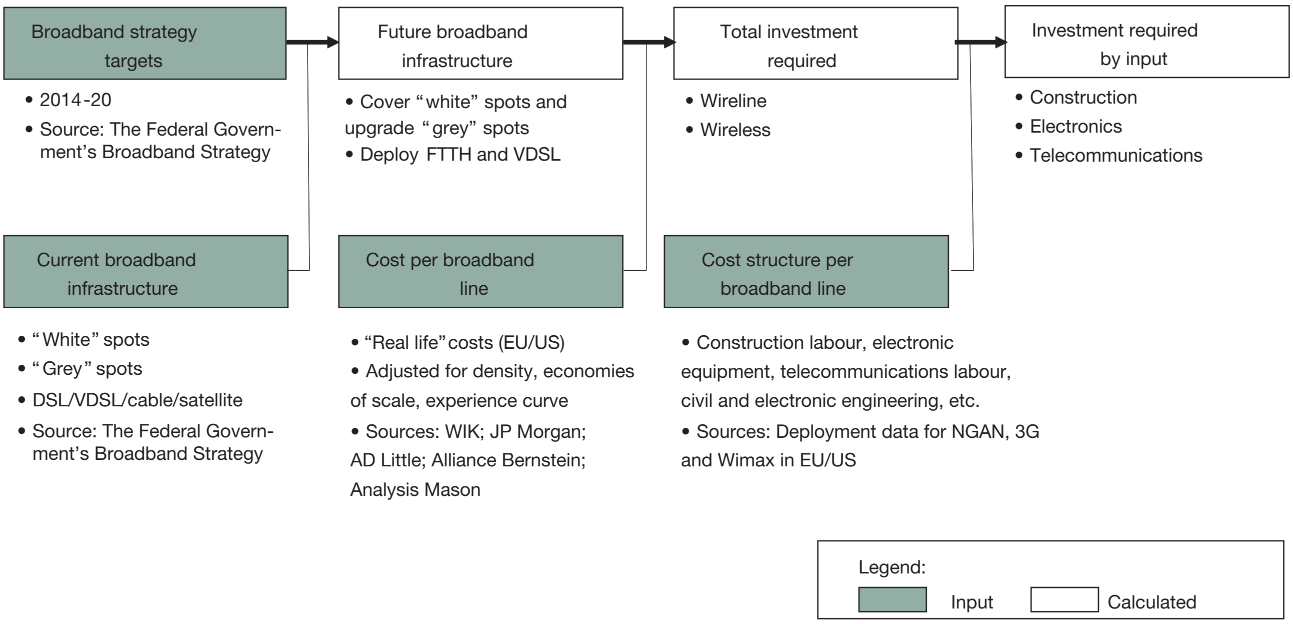
The study begins with an estimation of the investment required to deploy broadband technology to meet the targets outlined in the National Broadband Strategy and in the ultra-broadband evolution. Using that basis, the estimates of the economic impact – both in terms of jobs and output (value added growth) – of implementing the National Broadband Strategy and long-term ultra-broadband evolution are presented and discussed.

1 To access references of academic research, please consult the full study report available at http://www.citi.columbia.edu.

2 See R. L. Katz: La Contribución de las tecnologías de la información y las comunicaciones al desarrollo económico: propuestas de América Latina a los retos económicos actuales, Madrid, 2009, Ariel.

3 BMWi: The Federal Government's Broadband strategy, as at Feburary 2009, http://www.bmwi.de/Englisch/Redaktion/Pdf/broadband-strategy,property=pdf,bereich=bmwi,sprache=en,rwb=true.pdf.

Figure 1
Methodology for Estimating Deployment Costs



Study Methodology

The study methodology comprises three modules: 1) an estimation of the total investment required to meet the broadband targets, 2) an assessment of the economic impact of construction of the broadband network required to meet those targets, and 3) an estimation of the economic impact to be achieved once the network is deployed.

Estimation of Total Investment for Broadband Deployment

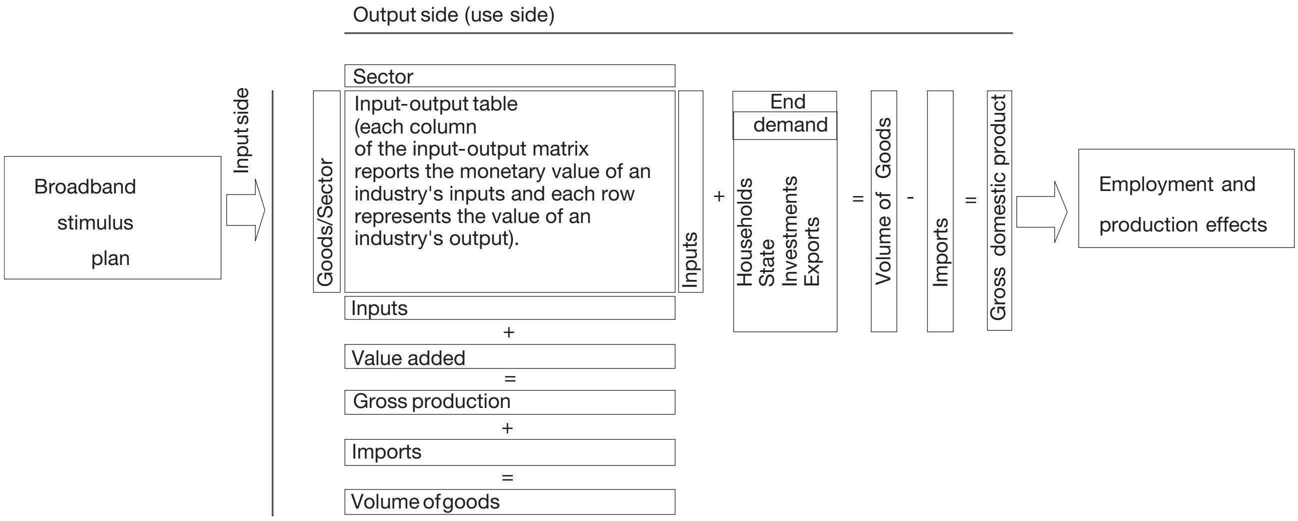
The coverage and service targets established by the Broadband Strategy are used to estimate the costs of deploying the targeted broadband infrastructure. Two sequential scenarios are defined: one for 2014, built around the strategy targets,[4] and one for 2020, defined on the basis of longer-term goals outlined in other government documents.[5]

Once defined, these targets will be compared to the current state of broadband deployment for which publicly available data has been analysed. Data on current coverage is based on the National Broadband Strategy and the Broadband Atlas produced by the Federal Ministry of Economics and Technology.[6] The comparison between the current situation and the targets allows us to estimate the deployment objectives in terms of the number of broadband lines to: 1) cover the "white" spots (unserved areas), 2) upgrade the "grey" spots (areas with low access speeds), and 3) deploy VDSL and FTTH. The additional lines required are estimated for different types of platforms (wireless, DSL, VDSL and FTTH).

Once the number of lines by service target has been estimated, they are multiplied by the costs per broadband line by type of platform. In order to determine the investment per line, the costs from deployment experience in Europe and the United States were relied upon, adjusted for factors such as urban density, economies of scale and experience curve.[7] This calculation yields the total investment required for wireless and wireline technologies. The total investment is split according to three cost categories: 1) construction labour, 2) electronic equipment, and 3) telecommunications labour.[8] The resulting process yielded the amount of total investment by cost category.

4 See BMWi, op. cit.
5 BMWi: Konjunkturgerechte Wachstumspolitik Jahreswirtschaftsbericht 2009, http://www.bmwi.de/BMWi/Redaktion/PDF/Publikationen/jahreswirtschaftsbericht-2009,property=pdf,bereich=bmwi,sprache=de,rwb=true.pdf.
6 BMWi: Der Breitbandatlas des BMWi, http://www.zukunft-breitband.de/BBA/Navigation/breitbandatlas.html.
7 See, in particular, D. Elixmann, D. Ilic, K-H. Neumann, T. Pluckebaum: The Economics of Next Generation Access: Final Report. Study for the European Competitive Telecommunication Association (ECTA), WIK Consult, Bad Honnef 2008.
8 These splits are based on cost allocations based on "real life" deployment data for NGAN (furnished by a European operator) and for 3G and Wimax for a US operator.

Figure 2
Structure of Input-Output Table



Assessment of Economic Impact of Network Construction

The assessment of the economic impact of network construction comprised the evaluation of effects on jobs and economic output. There are three types of construction effects. First, network construction requires the creation of direct jobs (for example, telecommunications technicians, construction workers and manufacturers of the required telecommunications equipment). In addition, the creation of direct jobs has an impact on indirect employment (jobs in businesses buying and selling to each other in support of direct spending). Finally, the household spending based on the income generated from the direct and indirect jobs leads to the creation of induced employment. To calculate the impact of broadband construction on employment and output, we rely on input-output analysis.

Input-output tables calculate the direct, indirect and induced employment and production effects of network construction. The interrelationship of these three effects can be measured through multipliers, which estimate total employment change throughout the economy from one unit change on the input side. In this study, the German input-output matrix supplied by Eurostat and originally developed by the Federal Statistical Office is utilised.

Estimation of the Economic Impact to Be Achieved after Network Deployment

Once deployed, the broadband infrastructure yields three types of economic impact. First, business firms might improve their productivity as a result of the adoption of more efficient business processes enabled by broadband services. Secondly, broadband deployment yields an acceleration of innovation resulting from the introduction of new broadband-enabled applications and services. Thirdly, broadband can have an impact on the composition and deployment of industry value chains. In other words, broadband can facilitate the transfer of employment from other regions and countries as a result of the ability to process information and provide services remotely.

The estimation of economic impact achieved after network deployment is conducted through econometric modelling. This is performed in three steps. First, statistically significant causal models are specified for German historical data sets. These data include broadband adoption, GDP growth, population growth and other time series between 2000 and 2006 at the *Landkreise* level. Data from the Federal Statistical Office, the Bundesamt für Bauwesen und Raumordnung and the Broadband Atlas produced by the Federal Ministry of Economics and Technology are used.

Once the models are specified, they are utilised to forecast economic and employment growth as a result of an increase in broadband penetration (the independent variable). The increase in broadband penetration was estimated by inferring the net result of the broadband strategy. Once the estimates for employment and economic impact resulting from network deployment and externalities are generated, they are annualised and compiled to yield both aggregate and annual effects.

Broadband Investment in Germany

According to our estimates, based on data from the National Broadband Strategy, 39 million of all 39.7 million German households[9] have access to some type of broadband technology (see Table 1). Of these, 36.7 million can be served by DSL, 22.0 million are passed by cable TV networks (and therefore potentially connected via a cable modem), and 730,000 can access the internet via fixed wireless or satellite technology. The remaining non-covered households, so-called "white spots", which comprise two per cent of households (or 730,000), are either located in less densely populated areas or near the outer boundaries of connected areas.

In addition to improving coverage, Germany has been making considerable strides in terms of raising the access speed of residential broadband users. The National Broadband Strategy reports that 98% of all German households have access to broadband internet with transmission rates of at least 384 Kbps, while 92% of households are served by lines with rates of at least 1 Mbps. About 2.8 million households are in "grey spots", meaning that they have broadband access between 384 Kbps and 1 Mbps.

Germany is currently undergoing three levels of fibre deployment: 1) Fibre to the Main Distribution Frame for ADSL 2+ services for selected cities, 2) Fibre to the street cabinet for VDSL services, and 3) Fibre to the home (e.g. DTAG, NetCologne, M'net). In the case of VDSL, Deutsche Telekom has announced that 90% of households located in the largest 50 cities (approximately 10.9 million households) can have access to VDSL. Simultaneously, several municipal networks have launched or are planning to deploy FTTB networks, although only 240,000 households are covered. Deployment in this case is focused on the densely populated areas of their home markets.

The major cable players have all upgraded their networks to two-way Hybrid Fibre Coax, generally relying on DTAG ducts. Kabel Deutschland's acquisition of Orion in the first quarter of 2008 resulted in 7.6 million upgraded households passed (71% of homes passed). Unitymedia has 6.3 million upgraded households passed (72% of homes passed). Kabel BW has upgraded 91% of its network, passing 3.3 million homes. All players are offering DOCSIS 2.0 and planning to roll out DOCSIS 3.0 by the end of 2010.

Turning to the demand side, as of the end of 2008, there were 22.6 million broadband lines in Germany.[10] As a result, Germany has reached 58% household penetration, or 27% of its population. Assessing demand in light of the supply perspective indicates that 58% of households actually served by any combination of broadband technologies actually purchase service.

Table 1
Households Passed by Broadband

Technology	Coverage (million)	Subscribers (million)	Connected/ passed in %
DSL	36.7	20.9	57
Cable Modem	22.0	1.6	7
Fixed Wireless, satellite	0.730	0.092	13
FTTB	0.240	0.043	18
Total (assuming overbuilds)	39.0	22.6	58

Sources: DT; Kabel Deutschland; Unitymedia; M-net; Bundesnetzagentur.

The "National Broadband Strategy" and an Ultra-Broadband Scenario

The Federal Government of Germany has defined in its National Strategy two broadband strategy targets:[11]

- provide nationwide broadband access (1 Mbps) by the end of 2010;
- by 2014, 75% of German households should have access to a broadband connection of at least 50Mbps, with the goal that such access lines should be available as soon as possible throughout the country.

The deployment actions required to meet these targets are fourfold. First, the 730,000 unserved households ("white spots") will be covered by a mix of wireless and wireline technology. It is assumed, following Deutsche Telekom's recent announcement, that 250,000 unserved households will be covered by DSL technology, while the remainder will be covered by wireless technologies. The second action will be to upgrade the 2.8 million "grey spot" households to 1 Mbps.

Turning to the second target of the National Broadband Strategy, 75% of households should be served by at least 50 Mbps by 2014 and higher bandwidths beyond. This deployment should occur in two stages:

- Upgrade to FTTH: It is assumed that 9.92 million households (representing 25% of German households) will be

9 Federal Statistical Office Germany 2006.

10 Source: Bundesnetzagentur Jahresbericht 2008, 2009.

11 See BMWi, op. cit.

upgraded to FTTH, given that VDSL technology deployed in dense cities has limits to its speed capabilities of 50 Mbps. Since the current number of households served by VDSL is 10.9 million and they are located in the 50 largest German cities, it is assumed that the majority of them will be migrating from VDSL to FTTH.

- Upgrade to VDSL: For this, it is assumed that the remaining 50% of households will be upgraded from DSL to VDSL. According to this calculation, it is estimated that the broadband lines to be connected as a result of this effort will be approximately 18.9 million.

To sum up, the broadband strategy will require the following investments to be completed by 2014:

- unserved households (730,000) covered by a mix of wireless (480,000 lines) and wireline technologies (250,000 lines);
- “grey zone” households (2.8 million) upgraded to 1 Mbps;
- 9,930,500 households (or 25%) upgraded to FTTH: these will come from the 240,000 where FTTH has already been deployed (municipalities) and by upgrading the rest from existing VDSL lines;
- 18.9 million households (or 50%) upgraded to VDSL: these will be comprised of the remaining existing VDSL lines (980,000) and upgrading an additional 17.9 million currently DSL lines.

Longer term aspirations, as mentioned in other government reports, foresee the construction of a national ultra-broadband infrastructure by 2020. We assume the objectives to be:

- deploy FTTH to 50% of households;
- deploy VDSL to the next 30% of households;
- offer broadband services under 50 Mbps to the remaining population (20%).

The action implied by these targets is the upgrading of an additional 25% of households to FTTH.

Total Investment Required to Meet Policy Targets

The calculation of total investment required has been conducted for each action by relying on costs per line. First, the combined wireline and wireless costs required

Table 2

Investment Required to Cover Unserved Households by 2014

Technology	Number of households	Cost per line (euros)	Total Investment (million euros)
DSL	250,000	1,200	300
Wireless	480,000	1,300	624
Total	730,000		924

Table 3

Total Investment Required to Achieve Objectives for 2014

Target	Amount (million euros)
Address the unserved “white spots”	924
Upgrade the “grey spots”	336
Deploy FTTH to 25% of households	12,236
Deploy VDSL to 50% of households	6,747
Total	20,243

to cover the unserved households will require 924 million euros for 2014, as depicted in the Table 2.

The calculation of VDSL and FTTH deployment relies on the actual cost per line adjusted for an increase of cost per household resulting from further deployment of the technology in the network. For example, in the case of FTTH, the initial 10% of households (3,972,000) will cost 1,150 euros per household to deploy, the next 10% will require 1,287 euros per household, and the next 10% will require 1,425 euros. In the case of VDSL, the first 10% of households will cost 300 euros, while further deployment to reach the target of 50% will require 450 euros per household. Based on these figures and the number of lines to be deployed, the investment required to meet the FTTH target is 12,236 million euros, while the investment required to meet the VDSL target would reach 6,747 million euros. To sum up, the total investment required to fulfil the 2014 National Broadband Strategy will be 20,243 million euros (see Table 3).

The incremental investment required to meet the FTTH target of 50% of households served by 2020 will be 15,690 million euros.[12]

12 The difference between the first 25% achieved in 2014 (12,236 million euros) and the second 25% achieved in 2020 (15,690 million euros) is due to two factors: 1) the first tranche benefits from the 240,000 households already served by municipal network roll-outs and, more importantly, 2) the cost per line in the second phase rises from 1,150-1,425 euros to 1,500-1,700 euros.

Job Creation and Economic Impact of Germany's Broadband Strategy

Employment and Economic Impact of Broadband Network Construction

The broadband investment is broken down into three primary sectors: manufacturing of electronic equipment, construction and telecommunications (see Table 4).

These estimates were entered into the input-output matrix for the German economy to estimate the impact of investment in network construction on jobs and the economy. Fulfilling the 2014 objectives of the National Broadband Strategy will generate 304,000 jobs over five years (between 2010 and 2014). The primary sector benefitting in terms of job creation will be construction with 125,000, followed by telecommunications (28,400) and electronics equipment manufacturing (4,700). The total number of indirect jobs generated by sector interrelationships measured in the input-output matrix will be 71,000 (see Table 5). The key sectors benefitting from the indirect effects are distribution (10,700), other services (17,000) and metal products (3,200). Finally, household spending generated directly and indirectly will result in 75,000 induced jobs. Based on these estimates, the Type I multiplier for employment is 1.45 and Type II is 1.92.[13]

Additionally, the implementation of the expected ultra-broadband evolution would generate 237,000 incremental jobs between 2015 and 2020. Similar to the breakdown shown above, this figure comprises 123,000 direct jobs, 55,000 indirect jobs and 59,000 induced jobs.

The labour intensive nature of broadband deployment ensures that the construction jobs to be created are significant and, despite the highly technological nature of the ultimate product, broadband is to be seen as being similarly economically meaningful as conventional infrastructure investments such as roads and bridges.

The investment for meeting the targets of the 2014 broadband strategy (20,243 million euros) will generate the additional production of 52,324 million euros in total (see Table 6). This means that for each euro invested in broadband deployment, 2.58 euros will be generated in output. Of this, 4,146 million euros (8% of total output) will be based on imported goods, which indicates a relatively low level of output "leakage" to other national economies. Of the

13 Type I multipliers measure the direct and indirect effects (direct plus indirect divided by the direct effect), while Type II multipliers measure Type I plus induced effects (direct plus indirect plus induced divided by the direct effect).

Table 4
Breakdown of Broadband Investment to Fulfil the Broadband Strategy and 2020 Scenario

	Inputs	Wireline		Wireless		Total
		%	million euros	%	million euros	million euros
2014	Electronics	12	2,354	45	281	2,635
	Construction	67	13,145	34	212	13,357
	Telecommunications	21	4,120	21	131	4,251
	Total		19,619		624	20,243
2020	Electronics	12	1,883	45	0	1,883
	Construction	67	10,512	34	0	10,512
	Telecommunications	21	3,295	21	0	3,295
	Total		15,690		0	15,690

Table 5
Total Employment Impact of Broadband Network Construction

Type of Impact	2014 National Broadband Strategy	2020 Ultra Broadband	Total
Direct effect	158,000	123,000	281,000
Indirect effect	71,000	55,000	126,000
Induced effect	75,000	59,000	134,000
Total	304,000	237,000	541,000
Type I multiplier	1.45	1.45	
Type II multiplier	1.92	1.93	

Table 6
Industrial Output of Broadband Construction
(in million euros)

	2014 National Broadband Strategy	2020 Ultra Broadband	Total
Investment	20,243	15,690	35,933
Total additional production	52,324	40,749	93,073
· Domestic	48,178	37,609	85,787
Additional value added	18,733	14,631	33,364
Intermediate outputs	29,466	22,978	52,444
· Imported	4,146	3,148	7,294

remaining production, 18,733 million euros would be additional GDP (+ 0.15%). Again, each euro invested in broadband deployment will trigger 0.93 euros in incremental GDP.

To sum up, the incremental GDP growth achieved by investing in broadband construction would amount to 33,364 million euros, which represents +0.12% of the German GDP.

Employment and Economic Impact of Externalities

The economic impact of broadband in terms of network externalities (that is, positive effects in employment and economic output resulting from enhanced productivity, innovation and value chain decomposition) have been found to be significant throughout Germany. The analysis of these effects has found that the economic stimulus impact of broadband is highest in the first year after deployment and tends to diminish over time. Results of the regression analysis for national time series between 2000 and 2006 indicate, with high significance levels, that increased broadband penetration has a strong impact on GDP growth, although the degree of impact tends to diminish over time.[14]

In addition, by splitting the national territory into two regions, *Landkreis*e with an average broadband penetration rate of 31% of the population in 2008 and *Landkreise* with average broadband penetration of 24.8%, we observe that the type of broadband network effects varies by region.[15]

In *Landkreis*e with high broadband penetration, the impact of broadband on both GDP and employment is very high in the short term, then declines over time. This "supply shock" is believed to occur because the economy can immediately utilise the newly deployed technology. Furthermore, the fact that employment and GDP grow in parallel indicates that broadband has a significant impact on innovation and business growth, thereby overcoming any employment reduction resulting from productivity effects.

On the other hand, in *Landkreis*e with low broadband penetration, the impact of broadband penetration on GDP is lower than in highly penetrated areas in the short term but "catches up" to comparable levels over time. With regard to employment, the impact of broadband, at least in the initial years, is slightly negative. This would indicate that the impact of broadband in poorly penetrated areas is more complex than in highly penetrated areas. The increase in broadband penetration in poorly penetrated areas takes longer to materialise because the economy requires a longer period of time to fully assimilate the technology. However, after three years the level of impact of broadband in poorly penetrated regions is as high as in the more developed areas. This is consistent with Jorgeson's findings on the lagged effect of ICT investment on productivity.[16] On the other hand, the fact that employment growth is initially negative would appear to indicate that a productivity increase resulting from the introduction of new technology is the most important network effect at work resulting in employment reduction. However, once the economy develops, the other network effects (innovation, value chain decomposition) start to play a more important role, resulting in job creation. Therefore, broadband deployment in poorly penetrated areas will likely generate high, stable economic growth ("catch up" effect) combined with capital/labour substitution that initially limits employment growth ("productivity" effect).

Based on these differentiated effects, the impact of broadband on economic growth and employment are estimated. In order to do this, it is stipulated that broadband penetration in advanced areas would increase by 14.9%, while the poorly penetrated areas would increase by 12.6%. This last trend is largely driven by the coverage of "white spots" and an improvement of service in "grey spots". These trends reflect an incremental increase in penetration of approximately 25% in both regions between 2008 and 2011.

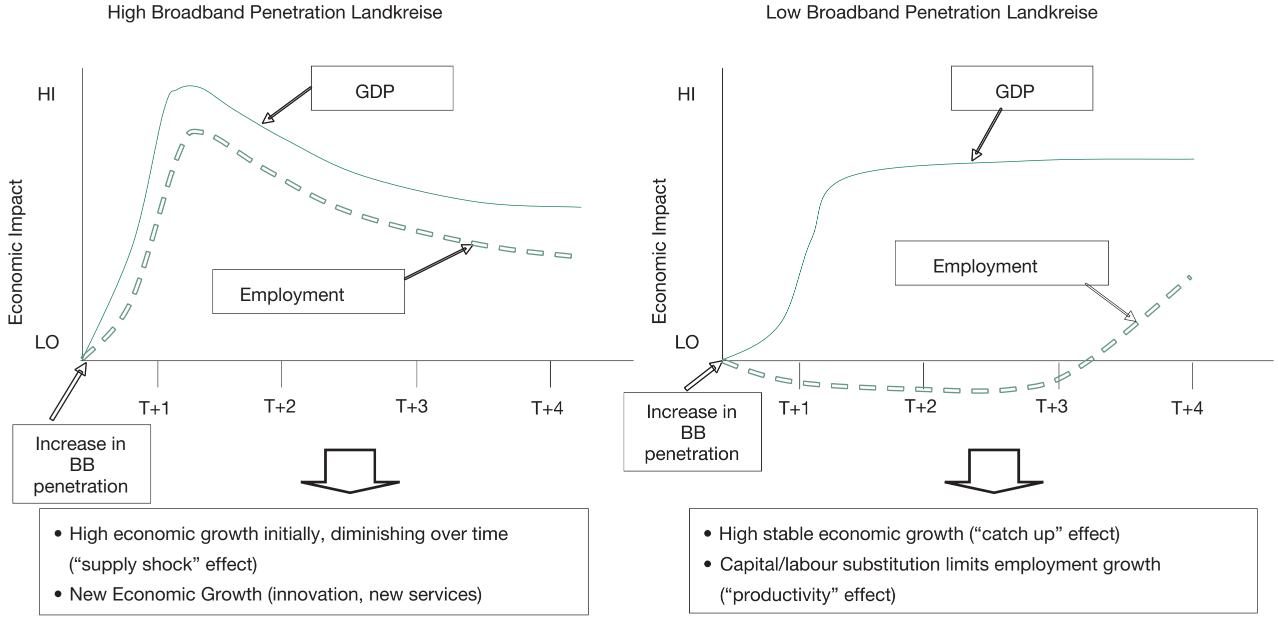
The percentage increase was input into the regression models specified for the time series 2000-2006. The regression models estimate an incremental annual GDP growth rate of 0.61 percentage points for poorly penetrated *Landkreise* and 0.64 percentage points for highly penetrated *Landkreis*e. These additional percentage point increases were applied to the GDP of both regions (estimated to be 1,698 billion euros for highly penetrated *Landkreise* and 791 billion for poorly penetrated *Landkreis*e). This resulted in an incremental GDP of 32,809

14 For full model estimates, please consult the study report available at http://www.citi.columbia.edu.

15 This is consistent with the results for the USA of W. Lehr, C. Osorio, S. Gillett, M. Sirbu: Measuring broadband economic impact, paper presented at the 33rd Research Conference on Communications, Information and Internet Policy, 23-25 September 2006, Arlington, Va.; M. Fornefeld, G. Delaunay, D. Elixmann: The impact of broadband on growth and productivity.: A study on behalf of the European Commission; D. Shideler, L. Taylor, N. Badasyan: The Economic Impact of Broadband Deployment in Kentucky, presentation at the Telecommunication Policy Research Conference, Washington DC, 28-30 September 2007.

16 See D. Jorgenson, M. Ho, J. Samuels, K. Stiroh: Productivity growth in the new millennium and its industry origins, Presentation to the Sloan Industry Studies Conference, Boston 2007.

Figure 3
Differential Economic Effects of Broadband by Region (Conceptual)



and 14,375 billion euros for highly and poorly penetrated *Landkreise* respectively. The total incremental GDP is 47,184 billion euros (+0.62%) in three years.

Regarding the impact on employment, following the same methodology, the creation of a total of 162,000 annual jobs over three years is expected, whereby the highly penetrated areas would contribute 132,000 and the poorly penetrated regions 30,000.[17] The differences across regions are driven by the divergent effects discussed above. Having estimated the three year (2009-11) employment and economic impact of incremental broadband penetration, the prorated annual increments were applied to the period 2012-2020 (54,000 jobs and 15.7 billion euros of GDP per year). However, in doing so, the impact during the years 2012-2014 was adjusted downward because a portion of the construction effect was already accounted for in the regression models, since these do not differentiate between construction and externalities. After 2014, no adjustments were made because, with the implementation of the National Broadband Strategy finished, the regression models would be primarily forecasting network effects. A similar adjustment was made to the GDP impact.

The different short-term economic impact between highly penetrated and poorly penetrated *Landkreise* prompts the question as to why investments should be made in the poorly penetrated areas if externalities are greater in more advanced regions. The answer is threefold: first, the impact in more advanced areas tends to decrease over time, which requires that the emphasis be shifted to the less penetrated regions in order to continue creating jobs; second, based on the "catch up" effect described above, it is expected that less penetrated areas will become engines of job creation in the long run; third, the intangible social benefits of addressing the "digital divide" problem remains an overriding imperative, regardless of the short-term employment effects.

Finally, as shown in Table 7, the estimates were generated for several years and dependent on stages of network deployment to indicate that the 541,000 jobs as well as the 33.4 billion euros of additional GDP generated by network construction do not occur all in one year but over the ten year period considered.

Conclusions

The National Broadband Strategy and the expected evolution of ultra-broadband through 2020 will have a signifi-

17 While it is not possible to determine, as in the case of network construction, what type of sectors would be most impacted by network externalities, experience indicates that highly developed areas will generate knowledge-intensive occupations such as R&D and product development, while less developed regions will attract low-end information intensive jobs, such as virtual call centres.

Table 7

Employment and Economic Impact per Annum

		2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Employment (in thousands)													
Network Construction	National Strategy	60.8	60.8	60.8	60.8	60.8							304.0
	Ultra Broadband						39.5	39.5	39.5	39.5	39.5	39.5	237.0
	Total	60.8	60.8	60.8	60.8	60.8	39.5	39.5	39.5	39.5	39.5	39.5	541.0
Network Externalities				24.0*	35.0*	44.0*	54.0	54.0	54.0	54.0	54.0	54.0	427.0
Total		60.8	60.8	84.8	95.8	104.8	93.5	93.5	93.5	93.5	93.5	93.5	968.0
Gross Domestic Product (in billion euros)													
Network Construction	National Strategy	3.8	3.8	3.8	3.8	3.8							18.8
	Ultra Broadband						2.4	2.4	2.4	2.4	2.4	2.4	14.6
	Total	3.8	3.8	3.8	3.8	3.8	2.4	2.4	2.4	2.4	2.4	2.4	33.4
Network Externalities				13.9*	14.5*	14.9*	15.7	15.7	15.7	15.7	15.7	15.7	137.5
Total		3.8	3.8	17.7	18.3	18.7	18.1	18.1	18.1	18.1	18.1	18.1	170.9

* Some overlapping of effects assumed.

cant impact on jobs and the German economy. It is estimated that a total investment of close to 36 billion euros would generate a total of 968,000 incremental jobs, of which 541,000 would be derived from construction of the network to meet the stipulated targets and 427,000 would be generated after the network is progressively deployed, resulting from enhanced innovation and new business creation.

From an incremental economic growth standpoint, network construction would yield an additional value added of 33.4 billion euros, while network externalities would result in an additional 137.5 billion euros. In total, this results in 170.9 billion euros of additional GDP (0.60% GDP growth) in Germany.

These economic returns on the planned broadband investment amply justify the need to move ahead with the announced plans, in particular to assure a political and regulatory framework geared toward growth and innovation. Broadband represents a high priority stimulus programme that the government needs to rely on to improve the current economic outlook and create a solid foundation for future growth. Since roll-out of the German broadband infrastructure is primarily based on private investment, the government's commitment to newly designed regulation geared toward growth and innovation is critical. The formulation of a regulatory framework which allows for appropriate risk diversification between investors and non-investors as well as for improved *a priori* planning and legal certainty for the investing companies represents a key element of the required investment-friendly environment.

Figure 4

Incremental Employment Impact for Germany

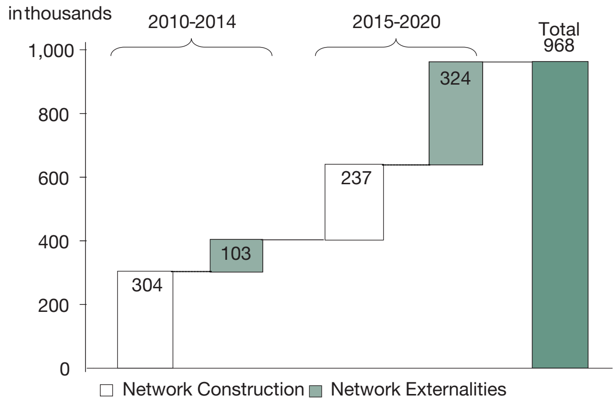


Figure 5

GDP Impact on the German Economy